International Standard 6587

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Paper, board and pulps — Determination of conductivity of aqueous extracts

Papier, carton et pâtes — Détermination de la conductivité des extraits aqueux

First edition — 1980-12-01

UDC 676.1/.7 : 54.056 : 537.31 **Ref. No. ISO 6587-1980 (E)**

Descriptors : paper, paperboards, paper pulps, tests, determination, conductivity.

Price based on 3 pages

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6587 was developed by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the member bodies in August 1979.

It has been approved by the member bodies of the following countries :

Australia	France	Norway
Austria	Germany, F. R.	Poland
Belgium	Hungary	Romania
Brazil	India	South Africa, Rep. of
Canada	Italy	Spain
Chile	Kenya	Sweden
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Czechoslovakia	Libyan Arab Jamahiriya	United Kingdom
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The member body of the following country expressed disapproval of the document on technical grounds :

USA

Printed in Switzerland

Paper, board and pulps — Determination of conductivity of aqueous extracts

1 Scope

This International Standard specifies a method for the determination of the conductivity of an aqueous extract of paper, board or pulps.

2 Field of application

This method is applicable to the aqueous extract made of all kinds of paper, board and pulps, except for papers used for electrical purposes. For high purity papers used for electrical purposes, the method used should be that given in IEC Publication 554.2.

3 References

ISO 186, *Paper and board — Sampling for testing.*

ISO 287, *Paper and board — Determination of moisture content — Oven-drying method.*

ISO 638, *Pulps — Determination of dry matter content.*

IEC Publication 554.2, *Specification for cellulosic papers for electrical purposes — Part 2 : Methods of test.*

4 Principle

Extraction of a sample of 2 g for 1 h with 100 ml of boiling distilled water. Measurement of the conductivity of the extract at 25 °C by means of a conductivity meter or resistance bridge, using alternating current.

5 Reagents

5.1 Distilled or deionized water.

Distilled or deionized water shall be used throughout the test. The conductivity of the water shall not exceed 0,1 mS/m after boiling and cooling as specified in 8.2. (See note 2.)

NOTES

1 Usually both distillation and deionization are required. Unless great care is exercised when distilling, and with the materials employed in the condenser and subsequent surfaces with which the condensed vapour may come in contact, the distillate may not reach the required level of conductivity.

2 When it is not possible to obtain water of the specified purity, water with a higher conductivity may be used, but the conductivity of the water used should be stated in the test report.

5.2 Potassium chloride, standard solutions.

Use potassium chloride (KCl) of recognized analytical reagent grade, powdered, or fine crystals. Dry for 2 h at 105 ± 2 °C and immediately prepare two solutions :

5.2.1 0,01 mol/l solution

Dissolve 0,745 6 g of the potassium chloride in water having a conductivity not greater than 0,1 mS/m, and dilute to 1 000 ml.

5.2.2 0,001 mol/l solution

Dilute 100 ml of the 0,01 mol/l solution (5.2.1) to 1 000 ml.

Store the solutions in waxed glass bottles with ground glass stoppers. The conductivity values of the two solutions are given in the table.

Table — Conductivity of potassium chloride standard solutions

Concentration	Temperature	Conductivity
mol/l	°C	S/m
0,01	18	0,122 05
	20	0,127 80
	25	0,140 88
0,001	25	0,014 693

6 Apparatus

Ordinary laboratory apparatus and

6.1 Flasks of chemically resistant glass, with ground glass joints, stoppers and efficient water-cooled reflux condensers made of the same quality of glass. All glassware shall be carefully rinsed with boiling distilled water (5.1).

6.2 Electrical heater, adjustable at least to 200 W.

6.3 Conductivity meter or resistance bridge, with measuring cells provided with black platinum electrodes of area approximately 1 cm^2, and capable of indicating the conductance of an aqueous extract with an error of less than ± 5 % in the frequency range of 50 to 3 000 Hz.

6.4 Constant-temperature bath, capable of maintaining a temperature of 25 ± 0,5 °C.

7 Sampling and preparation of the sample

7.1 Sampling

Sampling of paper and board shall be carried out in accordance with ISO 186.

Sampling of pulp shall be as representative as possible.

7.2 Preparation of sample

Cut or tear the sample into pieces approximately 5 mm × 5 mm in size from portions that have not been touched by bare hands. Mix the pieces thoroughly. The sample shall not be touched at any time with bare hands. Clean protective gloves shall be worn at all times to protect the sample and the pieces prepared from it. Store the prepared samples in clean covered containers.

7.3 Determination of dry matter content

Determine the dry matter content in accordance with ISO 287 for paper and board and ISO 638 for pulp.

8 Procedure

8.1 Determination of cell constant

Wash the measuring cell (see 6.3) several times with water (5.1), and then at least twice with the potassium chloride standard solution (5.2.1 or 5.2.2) the conductivity of which is nearest to that of the extract being measured.

Measure the conductance or resistance of the cell, by means of the conductivity meter or resistance bridge (6.3), with a fresh portion of the same potassium chloride standard solution.

Calculate the cell constant using the formula

$$J = \frac{\gamma_{KCl}}{G_{KCl}}$$

or

$$J = R_{KCl} \cdot \gamma_{KCl}$$

where

G_{KCl} is the conductance, in siemens, of the potassium chloride standard solution;

R_{KCl} is the resistance, in ohms, of the potassium chloride standard solution;

γ_{KCl} is the conductivity, in siemens per metre of the potassium chloride standard solution (see the table in 5.2).

NOTE — The conductance G is equal to $1/R$, where R is the resistance.

8.2 Preparation of aqueous extract

Weigh, to the nearest 0,002 g, exactly 2 g (oven-dry basis) of the sample (7.2) into a flask of suitable size (6.1). With a pipette, measure exactly 100 ml of water (5.1) into a separate flask (6.1). Attach the reflux condenser (6.1) and heat the water to almost boiling. Remove the condenser, add the almost boiling water to the flask containing the sample, then replace the reflux condenser and boil gently for 1 h on the electric heater (6.2). Cool rapidly, with the condenser still fitted, to about 25 °C. Let the fibres settle and then decant the extract. Prepare the extract in duplicate.

Using the constant-temperature bath (6.4), adjust the temperature of the extract to 25 ± 0,5 °C, and maintain that temperature throughout the test.

8.3 Determination of conductivity

Rinse the measuring cell (see 6.3) carefully several times with water, and then twice more with the extract. Measure the conductance or resistance with fresh portions of the extract until a constant value is obtained.

Repeat the determination with the duplicate extract.

Carry out a blank test, following exactly the same procedure as for the determination, but omitting the sample.

9 Calculation and expression of results

9.1 If the meter gives conductance

The conductivity γ of the extract is given, in millisiemens per metre, by the formula

$$\gamma = 1\,000 \times J(G_x - G_o)$$

where

J is the cell constant, determined as specified in 8.1;

G_x is the conductance, in siemens, of the extract;

G_o is the conductance, in siemens, of the blank test.

9.2 If the meter gives resistance

The conductivity γ of the extract is given, in millisiemens per metre, by the formula

$$\gamma = 1\,000 \times J\left(\frac{1}{R_x} - \frac{1}{R_o}\right)$$

where

J is the cell constant, determined as specified in 8.1;

R_x is the resistance, in ohms, of the extract;

R_0 is the resistance, in ohms, of the blank test.

9.3 Expression of results

Report the conductivity of the extract in millisiemens as the mean of two determinations to two significant figures. The individual results should not differ by more than 10 %; if they do, repeat the determination on two additional extracts and report the mean and the range of all measurements.

10 Test report

The test report shall include the following particulars :

a) all the information necessary for complete identification of the sample;

b) reference to this International Standard;

c) the results, expressed in millisiemens per metre;

d) the conductivity of the water used, where this is greater than 0,1 mS/m;

e) any unusual features observed in the course of the test;

f) any operations not specified in this International Standard or in the International Standards to which reference is made, or regarded as optional, which might have affected the results.